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Distribution of cattle trematodosis pathogens in the agroecosystems of the Fergana Valley (literature review)

Farg'ona vodiysi agroekotizimlarida qoramollar trematodozlari qo'zg'atuvchilarining tarqalishi (adabiyotlar sharhi)**Распространение возбудителей трематодозов крупного рогатого скота в агроэкосистемах Ферганской долины (обзор литературы)****O. MURODULLAYEV¹, J. M. ISAYEV¹**¹ *Scientific-Research Institute of Veterinary, Uzbekistan*

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ENGLISH

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Abstract. This article presents a literature-based review of the population and bioecological characteristics of the major trematode pathogens affecting cattle in the agroecosystems of the Fergana Valley, including *Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. and *Dicrocoelium dendriticum*. The life cycles of the trematodes, their intermediate hosts, their adaptation to environmental factors and the patterns of their distribution within agroecosystems were analysed. The climatic and hydrological conditions of the Fergana Valley were found to have a significant influence on the epizootiological processes of trematode infections.

Keywords: trematodosis; fasciolosis; dicrocoeliosis; paramphistomosis; agroecosystem; population; bioecology; cattle; intermediate host; Lymnaeidae; Fergana Valley

O'ZBEKCHA

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Annotatsiya. Maqolada Farg'ona vodiysi agroekotizimlarida qoramollarda uchraydigan asosiy trematodoz qo'zg'atuvchilari — *Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. va *Dicrocoelium dendriticum* ning populyatsion-bioekologik xususiyatlari adabiyotlar tahlili asosida yoritilgan. Trematodalarning rivojlanish sikli, oraliq xo'jayinlari, ekologik omillarga moslashuvi hamda agroekotizimlarda tarqalish qonuniyatlari tahlil qilingan. Farg'ona vodiysining iqlim va gidrologik sharoitlari trematodozlarning epizootologik jarayonlariga sezilarli ta'sir ko'rsatishi aniqlangan.

Kalit so'zlar: trematodoz; fassioloz; dikroselyoz; paramfistomatoz; agroekotizim; populyatsiya; bioekologiya; qoramol; oraliq xo'jayin; Lymnaeidae; Farg'ona vodiysi

РУССКИЙ

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Аннотация. В статье на основе анализа научной литературы рассмотрены популяционно-биоэкологические особенности основных возбудителей трематодозов крупного рогатого скота, распространённых в агроэкосистемах Ферганской долины, включая *Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. и *Dicrocoelium dendriticum*. Проанализированы жизненный цикл трематод, их промежуточные хозяева, адаптация к экологическим факторам и законо-

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мерности распространения в агроэкосистемах. Установлено, что климатические и гидрологические условия Ферганской долины оказывают существенное влияние на эпизоотологические процессы трематодозов.

Ключевые слова: трематодозы; фасциолёз; дикроцелиоз; парамфистоматоз; агроэкосистема; популяция; биоэкология; крупный рогатый скот; промежуточный хозяин; Lymnaeidae; Ферганская долина

1. KIRISH

Introduction

Qoramollar trematodozlari dunyo chorvachiligida keng tarqalgan parazitlar kasalliklari qatoriga kiradi. Ushbu kasalliklar mahsuldorlikning pasayishi, o'sish va rivojlanishning sustlashuvi, reproduktiv ko'rsatkichlarning yomonlashuvi hamda iqtisodiy zararlarining ortishiga sabab bo'ladi. Trematodozlar tarqalishida parazitlar biologiyasi, oraliq xo'jayinlarning ekologiyasi va tashqi muhit omillari muhim ahamiyat kasb etadi.

Farg'ona vodiysi sug'oriladigan dehqonchilik, rivojlangan chorvachilik va murakkab irrigatsiya tizimlari bilan ajralib turadi. Ushbu sharoitlar trematodalarning rivojlanishi uchun qulay ekologik muhit yaratadi. Shuning uchun mintaqada trematodoz qo'zg'atuvchilarining populyatsion-bioekologik xususiyatlarini o'rganish muhim ilmiy va amaliy ahamiyatga ega.

2. MAVZUNING DOLZARBLIGI

Relevance of the topic

Qoramollar trematodozlari dunyoning ko'plab mamlakatlarida chorvachilikka sezilarli iqtisodiy zarar yetkazuvchi invazion kasalliklar qatoriga kiradi. Ko'plab tadqiqotchilarning ma'lumotlariga ko'ra, fassioloz va paramfistomatoz kasalliklari hayvonlarda mahsuldorlikning pasayishi, ozuqa moddalari o'zlashtirilishining buzilishi, jigar va ovqat hazm qilish tizimida patologik o'zgarishlar rivojlanishi hamda reproduktiv ko'rsatkichlarning yomonlashishiga sabab bo'ladi. Shu jihatdan trematodozlar veterinariya parazitologiyasining dolzarb muammolaridan biri hisoblanadi.

Adabiyotlarda qayd etilishicha, qoramollarda trematodozlarni asosan Fasciola hepatica, Fasciola gigantica va Paramphistomum cervi qo'zg'atadi. Ushbu parazitlarning rivojlanish sikli murakkab bo'lib, oraliq xo'jayin sifatida Lymnaeidae oilasiga mansub mollyuskalar ishtirok etadi. Trematodalarning biologik rivojlanishi harorat, namlik, yog'ingarchilik, suv havzalari va sug'orish tizimlarining holatiga bevosita bog'liq bo'lib, ularning populyatsion dinamikasi ekologik omillar ta'sirida shakllanadi.

So'nggi yillarda olib borilgan ilmiy tadqiqotlar sug'oriladigan agroekotizimlarda trematodozlarning tarqalish darajasi tabiiy yaylovlarga nisbatan yuqoriroq ekanligini ko'rsatmoqda. Ayniqsa, Markaziy Osiyo davlatlarida, jumladan O'zbekiston hududida irrigatsiya tarmoqlarining kengligi, suv resurslaridan intensiv foydalanish va chorvachilikning rivojlanishi trematodalar hamda ularning oraliq xo'jayinlari uchun qulay ekologik sharoit yaratadi.

Farg'ona vodiysi respublikaning eng yirik agroindustrial hududlaridan biri bo'lib, rivojlangan sug'orish tizimlari, sernam biotoplar va qoramolchilik xo'jaliklarining ko'pligi bilan tavsiflanadi. Bunday sharoitlar trematodoz qo'zg'atuvchilarining saqlanib qolishi va tarqalishiga xizmat qilishi mumkin. Biroq mavjud ilmiy manbalar tahlili shuni ko'rsatadiki, Farg'ona vodiysi agroekotizimlarida qoramollar trematodozlari qo'zg'atuvchilarining populyatsion tuzilishi, bioekologik xususiyatlari, mavsumiy dinamikasi hamda agroiklim omillari bilan bog'liqligi yetarli darajada o'rganilmagan.

3. ADABIYOTLAR TAHLILI

Literature review

Qoramollar trematodozlari dunyoning ko'plab mamlakatlarida keng tarqalgan invazion kasalliklardan biri hisoblanib, chorvachilikka katta iqtisodiy zarar yetkazadi. Trematodozlar

orasida fassioloz va paramfistomatoz eng muhim kasalliklar qatoriga kiradi. Ushbu kasalliklar qoramollarda mahsuldorlikning pasayishi, tana vaznining kamayishi, reproduktiv ko'rsatkichlarning yomonlashishi hamda jigar va oshqozon-ichak tizimida chuqur patologik o'zgarishlarning rivojlanishiga sabab bo'ladi [1, 2].

Ko'plab tadqiqotchilar fassiolozning tarqalishi tabiiy va sun'iy suv havzalari, nam yaylovlarda hamda sug'oriladigan agroekotizimlar bilan uzviy bog'liqligini qayd etganlar. Fassiolozning asosiy qo'zg'atuvchilari bo'lgan Fasciola hepatica va Fasciola gigantica rivojlanish siklining ma'lum bosqichlarini suv muhitida o'tkazadi. Ularning biologik rivojlanishi uchun Lymnaeidae oilasiga mansub mollyuskalar zarur bo'lib, mazkur mollyuskalar parazitlarning oraliq xo'jayinlari vazifasini bajaradi [3].

K.I. Skryabinning fundamental tadqiqotlarida trematodalarning biologiyasi, sistematikasi va rivojlanish sikllari batafsil o'rganilgan. Muallifning ta'kidlashicha, trematodalar evolyutsiya davomida tashqi muhit omillariga yuqori darajada moslashgan bo'lib, ularning rivojlanish sikli xo'jayinlar almashinuvi orqali amalga oshadi. Bu esa parazitlarning tabiatda uzoq muddat saqlanib qolishiga imkon yaratadi [4].

M.D. Soninning ma'lumotlariga ko'ra, trematodalarning populyatsion barqarorligi ularning yuqori reproduktiv potentsiali bilan bog'liq. Voyaga yetgan bitta fassiola bir sutka davomida 20–30 mingtagacha tuxum qo'yishi mumkin. Tuxumlarning katta qismi tashqi muhitga ajralib chiqib, qulay ekologik sharoitlarda rivojlanishning keyingi bosqichlariga o'tadi. Shu sababli trematodozlar epizootik jarayonining uzluksiz saqlanib qolishida parazitlarning serpushtligi muhim omil hisoblanadi [5].

A.A. Galkinning tadqiqotlarida fassiolalarning populyatsion ekologiyasi o'rganilib, ularning son dinamikasi harorat, namlik va suv havzalari holati bilan chambarchas bog'liqligi ko'rsatib berilgan. Muallifning fikricha, haroratning 20–30 °C oralig'ida bo'lishi tuxumlardan miratsidiylarning chiqishi hamda mollyuskalarda serkariyalari rivojlanishi uchun optimal sharoit yaratadi [6].

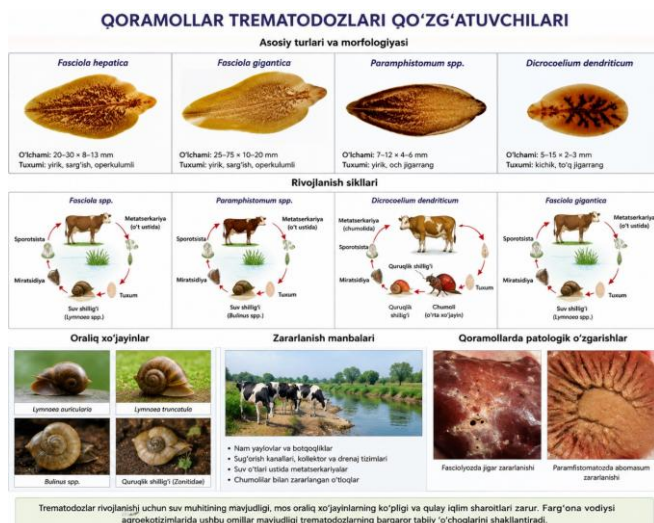
Markaziy Osiyo hududida olib borilgan tadqiqotlar natijalariga ko'ra, Fasciola gigantica issiq iqlim sharoitlariga yaxshiroq moslashganligi sababli F. hepatica ga nisbatan kengroq tarqalgan. O'zbekistonning sug'oriladigan hududlarida, ayniqsa Farg'ona vodiysi, Xorazm va Surxondaryo viloyatlarida ushbu turning ustunligi kuzatiladi [7, 8].

S. Mas-Coma va hammualliflar tomonidan olib borilgan tadqiqotlarda fassiolozning global tarqalishi va ekologik omillarga bog'liqligi tahlil qilingan. Mualliflar iqlim o'zgarishi, suv resurslaridan foydalanishning ortishi hamda antropogen omillar trematodalar va ularning oraliq xo'jayinlari arealining kengayishiga olib kelayotganligini ta'kidlaydilar [9].

Paramfistomatoz qo'zg'atuvchilari ham qoramollarda keng tarqalgan trematodalar qatoriga kiradi. Paramfistomatidalar rivojlanish siklida ham suv mollyuskalari ishtirok etadi. Voyaga yetgan parazitlar kavsh qaytaruvchilarning katta qorin bo'limida parazitlik qilsa, lichinkalik bosqichlari ichak shilliq qavatida rivojlanib, kuchli yallig'lanish va funksional buzilishlarni yuzaga keltiradi [10].

So'nggi yillarda olib borilgan tadqiqotlar irrigatsiya tizimlarining kengayishi trematodozlar epizootologiyasiga sezilarli ta'sir ko'rsatishini ko'rsatmoqda. Sug'orish kanallari, kollektor-drenaj tizimlari va sun'iy suv havzalari mollyuskalar populyatsiyasining

ortishiga sabab bo'ladi. Natijada tashqi muhitning invazion li-chinkalar bilan zararlaniş darajasi ortib, qoramollarning kasallanish xavfi kuchayadi [11, 12].



1-rasm. Qoramollar trematodozlari qo'zg'atuvchilarining rivojlanish sikli va ekologik bog'liqligi / **Fig. 1.** Life cycle of cattle trematodosis pathogens and its ecological dependencies

Farg'ona vodiysi agroekotizimlari yuqori antropogen yuklama, rivojlangan irrigatsiya tarmoqlari va qulay agroiklim sharoitlari bilan tavsiflanadi. Ushbu omillar trematodalar va ularning oraliq xo'jayinlari populyatsiyalarining shakllanishi hamda saqlanib qolishi uchun qulay ekologik muhit yaratadi. Shunga qaramasdan, mintaqada trematodoz qo'zg'atuvchilarining populyatsion tuzilishi, mavsumiy dinamikasi va ekologik omillar bilan bog'liqligi bo'yicha kompleks tadqiqotlar yetarli darajada amalga oshirilmagan. Bu esa mazkur yo'nalishda chuqur ilmiy izlanishlar olib borishni taqozo etadi.

4. XULOSALAR

Conclusions

1. Adabiyotlar tahlili shuni ko'rsatdiki, qoramollar trematodozlari (*Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. va boshqa turlar) chorvachilikka katta iqtisodiy zarar yetkazuvchi, keng tarqalgan invazion kasalliklar qatoriga kiradi. Ushbu parazitlarning rivojlanish sikli suv muhitlari va oraliq xo'jayinlar bilan chambarchas bog'liq bo'lib, ularning populyatsion barqarorligi yuqori reproduktiv salohiyat hamda ekologik omillarga moslashuvchanligi bilan tavsiflanadi.

2. Farg'ona vodiysining sug'oriladigan agroekotizimlari, rivojlangan irrigatsiya tarmoqlari, sernam biotoplar va qulay agroiklim sharoitlari trematodalar hamda ularning oraliq xo'jayinlari populyatsiyalarining shakllanishi va saqlanib qolishi uchun ekologik jihatdan qulay muhit yaratadi. Bu esa mintaqada trematodozlarning tabiiy va antropurgik o'choqlari barqarorligini ta'minlovchi asosiy omillardan biri hisoblanadi.

3. Trematodoz qo'zg'atuvchilari populyatsiyasining shakllanishi va epizootik jarayonning intensivligi harorat, namlik, suv havzalari holati, sug'orish tizimlarining rivojlanganligi hamda oraliq xo'jayin mollyuskalar zichligi bilan bevosita bog'liqdir. Shu sababli ushbu omillar trematodozlarning tarqalishini prognozlash va epizootik xavf darajasini baholashda muhim indikator sifatida xizmat qiladi.

4. Mavjud ilmiy manbalar tahlili Farg'ona vodiysi agroekotizimlarida trematodoz qo'zg'atuvchilarining populyatsion tuzilishi, bioekologik xususiyatlari va mavsumiy dinamikasi bo'yicha kompleks tadqiqotlar yetarli darajada olib borilmaganligini ko'rsatdi. Bu esa mintaqaviy epizootologik monitoring tizimini takomillashtirish va ilmiy asoslangan prognozlash usullarini ishlab chiqishni taqozo etadi.

5. Trematodozlarga qarshi kurashning samaradorligini oshirish uchun epizootologik monitoring, oraliq xo'jayinlar populyatsiyasini nazorat qilish, yaylov va suv manbalarining veterinariya-sanitariya holatini yaxshilash hamda profilaktik degelmintizatsiya tadbirlarini agroekologik sharoitlarni hisobga olgan holda kompleks ravishda amalga oshirish maqsadga muvofiqdir.

DECLARATIONS

Declarations

Author contributions ^{CRedit}

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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Ethics approval

The article is a review of published scientific literature. The work involved no experiments on animals and no human participants, and therefore required no separate ethics committee approval.

Informed consent

All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The study involved no human participants and no personal data.

Data availability statement

All data discussed in this review are taken from the publications listed in the reference list and are available from those sources.

Conflict of interest

The authors declare no conflict of interest.

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Generative AI disclosure

Generative AI was used only partially. The authors used Claude (Anthropic, Opus 5) for language editing, formatting of the reference list and preparation of the English and Russian metadata. No text, data, figures or conclusions were generated by AI. The authors reviewed and verified all output and take full responsibility for the content of the publication.

EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Purpose and research problem

Trematodoses of cattle are among the most widespread parasitic diseases in world animal husbandry. They reduce productivity, slow growth and development, impair reproductive performance and cause substantial economic losses. The spread of trematodoses depends on the biology of the parasites, the ecology of their intermediate hosts and environmental conditions. The Fergana Valley is distinguished by irrigated agriculture, well-developed animal husbandry and a complex irrigation network; these conditions create a favourable ecological environment for the development of trematodes. The main causative agents recorded in cattle are *Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. and *Dicrocoelium dendriticum*, and their development involves molluscs of the family Lymnaeidae as intermediate hosts. Although the Fergana Valley is one of the largest agro-industrial regions of the republic, with extensive irrigation systems, humid biotopes and numerous cattle farms, analysis of the available literature shows that the population structure, bioecological characteristics, seasonal dynamics and dependence on agroclimatic factors of trematode pathogens in the agroecosystems of this region have not been studied sufficiently. The purpose of this article is therefore to review and systematize the published data on the population and bioecological characteristics of the principal cattle trematode pathogens, on their life cycles and intermediate hosts, and on the ecological conditions that determine their distribution in the irrigated agroecosystems of the Fergana Valley.

Materials and methods

The article is a literature review. It is based on the analysis of published scientific sources: classical monographs and textbooks on veterinary parasitology and helminthology, fundamental works on the biology, systematics and life cycles of trematodes, regional studies on the helminths of domestic ruminants in Uzbekistan and Central Asia, and international publications on the global distribution of fasciolosis and other plant-borne trematode zoonoses. Twelve sources were analysed. The review considered, for each group of pathogens, the morphological characteristics of the adult parasites and their eggs, the stages of the life cycle passed in the aquatic environment, the species of intermediate host molluscs involved, and the environmental factors reported to govern development and survival — temperature, humidity, precipitation, the state of water bodies and the condition of irrigation systems. Data on the agroclimatic and hydrological conditions of the Fergana Valley were compared with the ecological requirements of the parasites and their intermediate hosts described in the literature. No original experiment, sampling scheme or statistical analysis was carried out; the conclusions are based on the comparative analysis of published data.

Results and discussion

The analysis confirmed that fasciolosis and paramphistomosis are the most important trematodoses of cattle and that they cause reduced productivity, loss of body weight, impaired absorption of nutrients, deterioration of reproductive performance and deep pathological changes in the liver and the gastrointestinal tract. The distribution of fasciolosis is closely bound to natural and artificial water bodies, humid pastures and irrigated agroecosystems, because *Fasciola hepatica* and *Fasciola gigantica* pass defined stages of their life cycle in the aquatic environment and require molluscs of the family Lymnaeidae as intermediate hosts. Fundamental work on the biology and systematics of trematodes shows that these parasites are highly adapted to environmental factors and that their life cycle proceeds through an alternation of hosts, which allows them to persist in nature for long periods. Population stability is supported by a very high reproductive potential: a single adult fluke may lay up to twenty to thirty thousand eggs per day, and a large part of these eggs is shed into the environment, where under favourable ecological conditions they proceed to the following developmental stages; the fecundity of the parasites is therefore a key factor in the continuity of the epizootic process. Studies of the population ecology of *Fasciola* show that their numerical dynamics are closely linked to temperature, humidity and the state of water bodies, with a temperature range of 20–30 °C being optimal for the hatching of miracidia from eggs and for the development of cercariae in molluscs. In Central Asia, *Fasciola gigantica* is more widely distributed than *F. hepatica* because it is better adapted to a hot climate, and its predominance is observed in the irrigated regions of Uzbekistan, notably in the Fergana Valley, Khorezm and Surkhandarya. International analyses of the global distribution of fasciolosis indicate that climate change, the increasing use of water resources and anthropogenic factors are expanding the range of trematodes and their intermediate hosts. Paramphistomes are also widespread in cattle; aquatic molluscs likewise take part in their life cycle, the adult parasites occurring in the rumen of ruminants while the larval stages develop in the intestinal mucosa and cause severe inflammation and functional disturbance. Recent work shows that the expansion of irrigation systems significantly affects the epizootiology of trematodoses: irrigation canals, collector and drainage systems and artificial reservoirs increase mollusc populations, so that contamination of the environment with invasive larvae rises and the risk of infection in cattle grows. The agroecosystems of the Fergana Valley combine a high anthropogenic load, developed irrigation networks and favourable agroclimatic conditions, all of which create an ecologically favourable environment for the formation and persistence of populations of trematodes and their intermediate hosts.

Conclusion and contribution

Cattle trematodoses caused by *Fasciola hepatica*, *Fasciola gigantica*, *Paramphistomum* spp. and other species are widespread invasive diseases that inflict considerable economic damage on animal husbandry; their life cycles are closely bound to aquatic environments and intermediate hosts, and their population stability rests on high reproductive potential and adaptability to environmental factors. The irrigated agroecosystems of the Fergana Valley, with their developed irrigation networks, humid biotopes and favourable agroclimatic conditions, form an ecologically favourable environment for the formation and persistence of populations of trematodes and their intermediate hosts, and this

is one of the principal factors sustaining natural and anthropogenic foci of trematodoses in the region. The formation of pathogen populations and the intensity of the epizootic process depend directly on temperature, humidity, the state of water bodies, the development of irrigation systems and the density of intermediate host molluscs, so these factors serve as important indicators for forecasting the spread of trematodoses and assessing the level of epizootic risk. The review also showed that comprehensive studies of the population structure, bioecological characteristics and seasonal dynamics of trematode pathogens in the agroecosystems of the Fergana Valley have not been carried out to a sufficient degree, which calls for improvement of the regional epizootiological monitoring system and the development of scientifically grounded forecasting methods. To increase the effectiveness of control, epizootiological monitoring, control of intermediate host populations, improvement of the veterinary-sanitary condition of pastures and water sources and preventive dehelminthization should be applied together, taking the agroecological conditions of the region into account. The contribution of this review lies in assembling, for the first time for the Fergana Valley, a consolidated picture of the pathogens, their intermediate hosts and the agroecological factors that govern them, and in identifying the specific gaps that regional field research now needs to close.

ADABIYOTLAR RO'YXATI

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